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Forest Health Management

Disease Survey of Buckhorn Creek Lodgepole Pine Stand Forty Years After Establishment , Canyon Lakes Ranger District, Arapaho and Roosevelt National Forests

Technical Report R2-63
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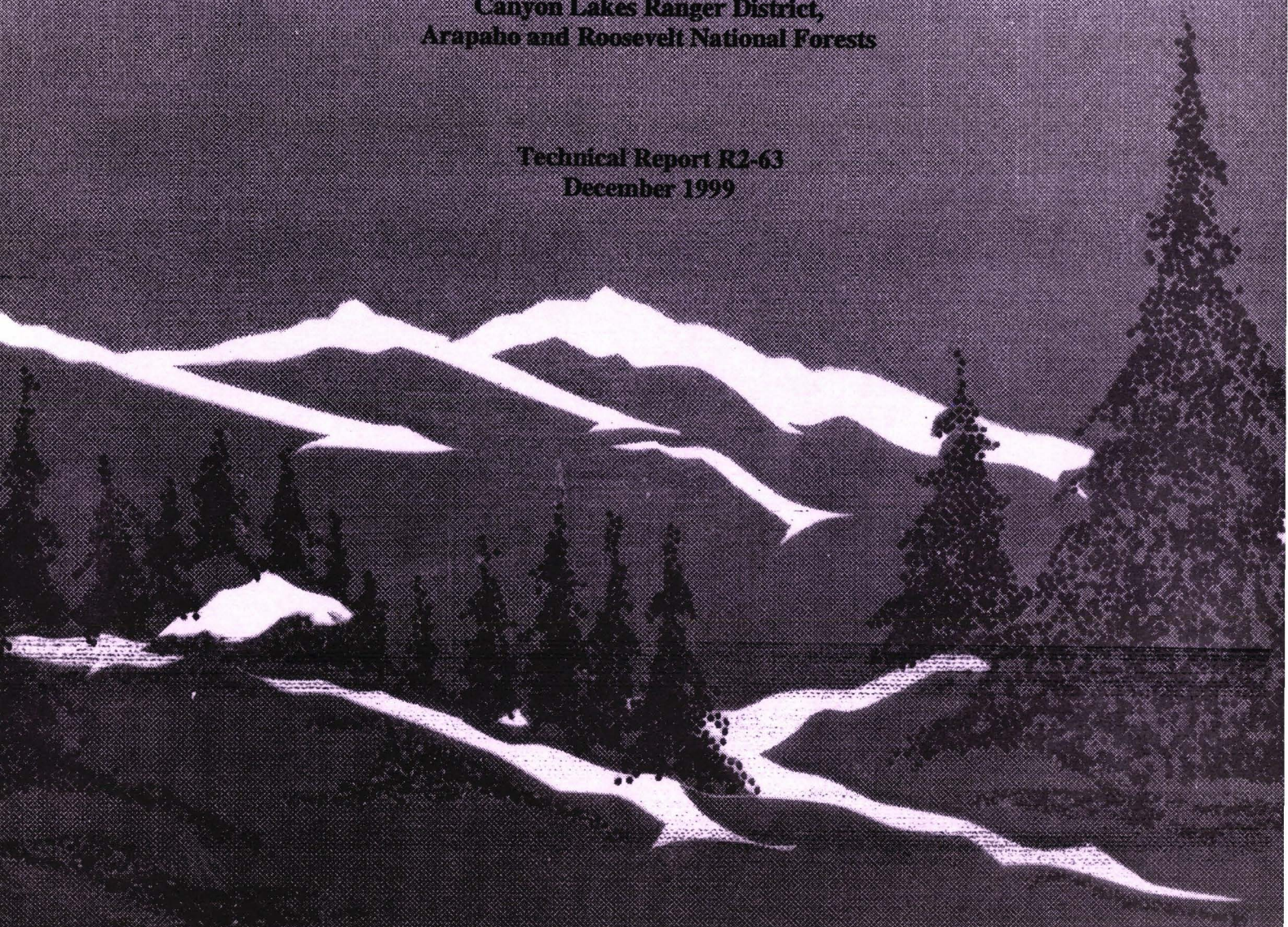

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by

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Introduction

In 1959, Dr. Frank Hawksworth established a series of plots in a 25 acre lodgepole pine stand that had been clearcut in about 1947 and had naturally regenerated. The stand, near Buckhorn Creek (T7N, R72W, Sects. 20,29), was located on the Poudre Ranger District (now Canyon Lakes Ranger District), Arapaho and Roosevelt National Forests. The stand was selected for survey since Armillaria root disease (*Armillaria ostoyae* (Romagn.) Herink) was detected and appeared to be of concern to the management of the developing stand.

Permanent plots were established in 1959 and monitored annually for five years. The results of those surveys are included in reports (USDA Forest Service 1960, 1961) and summarized in Table 1.

The stand was thinned in 1964 and then re-examined in 1977 by Johnson and Hawksworth prior to a second thinning (Johnson and Hawksworth 1977). A subsequent survey was performed in 1985 by Hildebrand and Kempert (Hildebrand and Kempert 1985).

It has been forty years since this stand was first surveyed, thus we were afforded an opportunity to compare observations on disease incidence, particularly *A. ostoyae*, and stand parameters over a relatively long time.

Previous Surveys and Methods

In 1959, the stand survey included 0.01 acre plots located at one chain intervals along transects that were ten chains apart. Sixty-three plots were established and monitored annually for five years. Annual losses to *A. ostoyae* were nearly two percent in 1960, but steadily declined to 0.4 percent by 1964 (Table 1).

Table 1. Annual and cumulative mortality of lodgepole pine to Armillaria root disease near Buckhorn Creek, Arapaho and Roosevelt National Forests from 1959 to 1964.

Year	Annual mortality (%)	Cumulative loss (%)
1959	--	6.4
1960	1.9	8.3
1961	1.3	9.6
1962	0.8	10.4
1963	0.8	11.2
1964	0.4	11.6

1/ From Johnson and Hawksworth 1977.

In 1977, root disease losses in the stand were again surveyed using 84, 0.01 acre plots located at one chain intervals along transects ten chains apart. All trees over three feet tall were examined for damaging agents and for symptoms of *A. ostoyae*. The average diameter was 4.3 inches and height 23 feet. Of the 1,292 trees per acre, 48 were killed by *A. ostoyae*. All the dead trees were suppressed, non-crop trees.

In 1985, the survey was conducted using the same methods as previously described with 67 plots measured. At that time the numbers of trees per acre averaged 439 (415 lodgepole pine, 12 Engelmann spruce, 9 subalpine fir and 3 aspen); 10 trees per acre were killed by *A. ostoyae.* All the dead trees were suppressed, non-crop trees. The average diameter of the lodgepole pine was 5.5 inches dbh and height 33 feet. Incidence of western gall rust, *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka) , averaged 39 infected trees per acre with main stem cankers. Branch galls were noted on an additional 19 crop trees per acre. Stalactiform rust, *Cronartium coleosporioides* Arth., and lodgepole pine dwarf mistletoe, *Arceuthobium americanum* Nutt. ex Engel., were present at low levels in the stand, but not causing significant losses.

Current Survey and Methods

On August 19, 1999, the stand was revisited, which was forty years after the first survey by Hawksworth. Survey strips were 10 chains apart and plots (0.01 acre) were located at one chain intervals. Fifty plots were measured. Ten trees were measured for height. Trees at least 3 feet tall, but under 4.0 inches dbh were recorded as regeneration. Damaging agents were recorded for all plot trees.

Results and Conclusions

A total of 232 lodgepole pine, 17 Engelmann spruce and 8 subalpine fir (514 trees per acre) were examined. Regeneration averaged 170 trees per acre and averaged 1.9 inches dbh. Western gall rust was recorded on 82 crop trees (35 percent) within the main stem (Figures 1,2). Other damaging agents noted were lodgepole pine dwarf mistletoe (4 percent), stalactiform rust, and elk rubbing; however, these agents were not significant. The average height and diameter of potential crop trees was 29 feet and 7.2 inches dbh, respectively. A summary of the stand parameters for the 1977, 1985 and 1999 surveys are presented in Table 2.

Table 2. Summary of stand parameters for the lodgepole pine stand near Buckhorn Creek, Arapaho and Roosevelt National Forests for 1977, 1985 and 1999.

Year	Stand age (yrs)	Ave. dbh (in.)	Ave. ht. (ft.)	TPA 1/	TPA 2/ w/ A.o.	TPA 3/ w/ WGR
1977	30	4.3	23	1292	48	N.A. 4/
1985	38	5.5	33	439	10	39 (9)
1999	52	7.2	29	514	0	164 (35)

1/ Trees per acre.
2/ Trees per acre with *Armillaria ostoyae* (non-crop trees).
3/ Trees per acre with western gall rust on main stem. Figure in ( ) is percent.
4/ Information not available or recorded in 1977.

At the time of plot establishment in 1959, Armillaria root disease was the focus of the survey; however, this disease is no longer causing significant losses in this stand. The current stocking (466 trees per acre) is sufficient for a stand of this age. The appearance of western gall rust, however is a concern and is expected to increase in the future as this rust spreads from pine to pine and as evidenced by the nearly four-fold increase in main stem cankers since 1985.

Damage caused by the rust includes killing of some infected trees, top killing above the canker, and weakening of the stem at the point of the canker. In time, bole breakage will occur which will result in small stand openings. These openings will gradually regenerate to the more shade tolerant tree species such as subalpine fir and Engelmann spruce. The resulting stand will be multistory and more diverse.

Additional investments in thinning or timber stand improvement projects are probably not warranted considering the incidence of the rust in the stand and lower value of main stem cankered trees.

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Figure 1. Typical main stem canker on lodgepole pine caused by western gall rust, Buckhorn Creek, Canyon Lakes Ranger District, 1999.

Figure 2. Multiple stem cankers on lodgepole pine caused by western gall rust, Buckhorn Creek, Canyon Lakes Ranger District, 1999.